<u>APPENDIX A</u>

Marked-up versions of the claimed amended by the Response filed March 26, 2003, are presented below.

<u>In the claims</u>:

22. (Amended) The laminate of claim 1, wherein the base film is a [Nucrel®-coated] polyethylene terephthalate film <u>coated with an ethylene acid copolymer resin</u>.

23. (Amended) The laminate of claim 1, wherein the base film is <u>an oriented propylene</u> [a Bicor LBW] film.

24. (Amended) The laminate of claim 1, wherein the base film is a <u>spunbonded olefin</u> [Tyvek®] film.

APPENDIX B

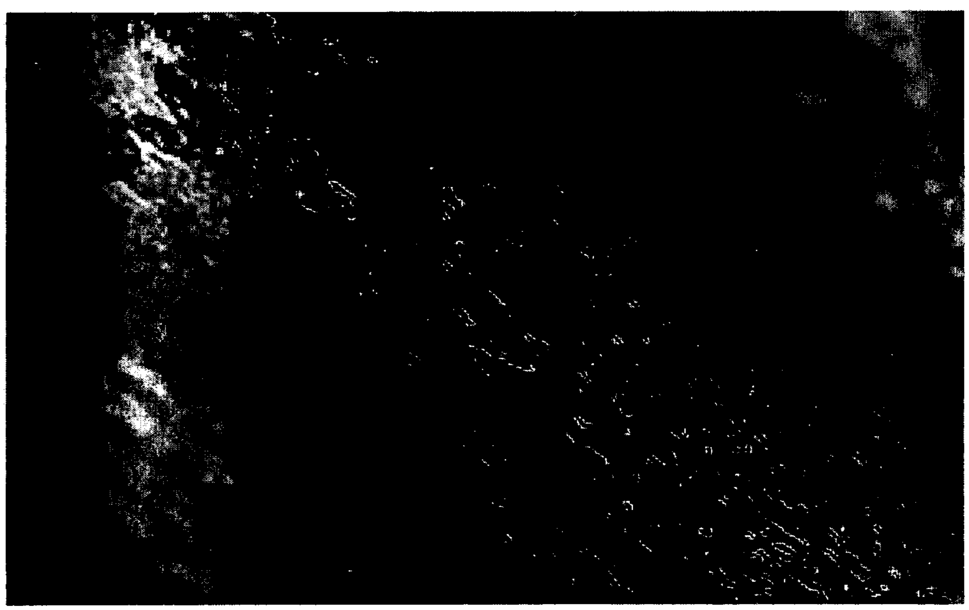
Osmosis

GRP craft can suffer from the effects of osmosis, dramatically r ducing their value. Commission a moisture survey befor purchasing a craft or wh n finding suspect defects in your craft.

Euro Marine Consultants can offer expert advice on the cause, prevention, treatment, and repair of damage caused by osmosis.

What is osmosis?

Osmosis is a general term to describe a condition whereby water is attracted into the laminations of a moulded hull. Polyester resins, commonly used in the construction of vessels, are, to some extent, water permeable and will absorb water.



Blistering and gel coat delamination caused by the effects of osmosis

What causes osmosis?

The general factors that contribute to osmosis are as follows:

The degree of resin cure - a resin that is not fully cured will be more permeable and consequently more prone to defects.

The use of resin additives - resins contain additives such as colour pigments and fillers in addition to catalyst and accelerator. The permeability resistance of the resin will be reduced if the additives are not added and mixed correctly.

The service environment - the ambient water temperature in some climates can cause softening of the resin and a reduction in permeability resistance. In addition, fresh water will permeate more freely than salt water due to its lower density.

How does osmosis occur?

A moulded hull comprises of a matrix of glass fibre strands bonded together by resin, separated from the water by a semi-permeable layer known as the gel coat. The gel coat, apart from giving the vessel its cosmetic appearance, has a structural protective role in keeping water out of the laminate. Due to the nature of the materials and the methods used in fabrication of laminated mouldings there will invariably be numerous micro-cavities dispersed throughout the gel coat and the lamination; these micro-cavities are an unavoidable feature of glass-reinforced plastic construction. There can also be cavities caused by either incomplete wetting of the glass fibre during laying up or by trapped air bubbles. The polyester resins used for bonding the glass fibre strands are semi-permeable and will absorb water. Water will permeate through the gel coat as soon as it is immersed, filling these micro-cavities. The water will degrade the resin, increase in density, and create an osmotic cell which attracts more water into the cavity. This will become evident as a blister on the surface of the hull.

What damage does osmosis cause?

The water-filled cavities will increase in pressure resulting blisters which cause the relatively weak resin to fracture and, in certain situations, the moulding will delaminate. Eventually the condition will become more widespread until the laminate looses structural strength.

What do osmotic blisters look like?

The action of osmosis causes blisters to appear in the gel coat and the laminations. These can be best described as follows:

Gel coat void blisters - this are caused by air bubbles trapped in the gel coat. These can fill with water which creates small blisters of up to 3mm in diameter to appear on the surface of the gel coat. Once these blisters rupture due to pressure a path is opened which allows further water penetration into the gel coat. This can eventually lead to moisture penetration of the laminate itself.

Interface blisters - this will appear where a change of permeability occurs, such as between two layers of gel coat, or between the gel coat and the laminate. These blisters are generally larger than 3mm and are easily exposed by removing the weaken gel coat.

Fibre aligned blisters - these will occur where moisture has penetrated the gel coat and collected in an underlying strand of glass fibre reinforcement, causing a reaction and swelling.

Prominent fibre blisters - also known as wicking, these occur where the glass fibre reinforcement has either penetrated the gel coat or is covered by a very thin layer of gel coat. Water is drawn along the strands by capillary action, penetrating deep into the laminate.

Inter laminate blisters - these arise from moisture collecting within the laminate, either by osmotic and/or capillary action. This will result in large blisters, 25mm or more in diameter, which are cause by an increase in pressure with the laminate and a distortion of the surface. This type of blistering will severely compromise the structural strength of the laminate.

How can osmosis be prevented?

Osmosis can be prevented by applying a protective coating to new and older vessels to prevent osmosis; however, care has to be taken with older hulls which may have a build-up of antifouling. For both new and older vessels the manufacturers instructions should be followed as the solvents used in the protective paints can result in problems - the best advice is to consult the manufacturer.

How can osmosis be treated?

The extent of any treatment for osmosis depends on the extent of gel coat damage and the likelihood of penetration into the hull laminates. The following are guidelines only and will vary from vessel to vessel depending on the type and extent of the damage and deterioration found:

Gel coat blistering - in situations where the blisters are restricted to the gel coat and where it can be demonstrated that moisture penetration into the laminates is at an early stage the following procedure may be required (bearing in mind that further local repair work may be required):

(i) Remove all antifouling, preferably be wet sand blasting. Do not remove the gel coat, but the actual gel coat blisters should be broken open.

(ii) The hull should be subjected to a moisture survey, the results of which should be recorded for comparison during the drying out period.

(iii) The hull should be left to dry out; moisture readings should be taken on a regular basis until the measured values drop to an acceptable level.

(iv) Local surface voids should be filled with a suitable filler and rubbed smooth.

(v) A suitable sealant should be applied in accordance with the manufacturers recommendations.

(vi) Antifouling should be applied in accordance with the manufacturers recommendations (remember to check for compatibility between paint systems).

(vii) The hull should be inspected every 6 months for at least two years to check for any new blisters - these should be locally repaired as given above.

Blisters extending into the laminates - in situations where the blisters extended penetration into the laminates the following procedure may be required:

(i) Remove all gel coat and the outer laminate surface, preferably be wet

sand blasting.

(ii) The hull should be subjected to a moisture survey, the results of which should be recorded for comparison during the drying out period.

(iii) The hull should be left to dry out; moisture readings should be taken on a regular basis until the measured values drop to an acceptable level.

(iv) Local voids and surface undulations should be filled with a suitable filler and rubbed smooth.

(v) A suitable sealant should be applied in accordance with the manufacturers recommendations.

(vi) Antifouling should be applied in accordance with the manufacturers recommendations (remember to check for compatibility between paint systems).

Large blisters, delamination, and structural weakness - in all situations where interlaminate blistering exists it is advisable to seek professional help. The following procedure may be required, however, the extent of structurally defective laminate will vary from vessel to vessel:

(i) Remove all gel coat and the outer layers of laminate, preferably be wet sand blasting.

(ii) The hull should be subjected to a moisture survey, the results of which should be recorded for comparison during the drying out period.

(iii) Defective areas of laminate should be cut out with the edges feathered.

(iv) The hull should be left to dry out; moisture readings should be taken on a regular basis until the measured values drop to an acceptable level.

(v) Repairs should be carried out using epoxy or isophthalic polyester resins and an appropriate weight of glass.

(vi) If necessary, the surface can be faired using with a suitable filler.

(vii) The entire surface should then be reinforced with at least two layers of laminate.

(viii) The surface should then be coated with epoxy or polyester resin applied in accordance with the manufacturers recommendations.

(vi) Antifouling should be applied in accordance with the manufacturers recommendations (remember to check for compatibility between systems).

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APPENDIX C

Technical Resources Area

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PLASCOAT PPA571ES

COMPARISON OF PLASCOAT PPA 571ES AND POLYESTER POWDER COATINGS

1. Plascoat PPA571ES is a **thermoplastic** powder coating which **melts** to form a fusion-bonded coating. Polyester powders, however, must first melt and **then chemically cross-link** to develop their physical properties and adhesion. The "curing" schedule is therefore critical for polyester powder coatings. PPA571 only has to melt onto the surface to provide adhesion, and when the coating is cooled full physical properties are ensured.
2. Plascoat PPA571ES has been formulated to give excellent **resistance to UV light** and water including acid rain and **salt spray**. Furthermore it offers excellent corrosion resistance when applied over mild steel, galvanised steel or aluminium.
3. Plascoat PPA571ES is applied at 150 to 250 microns or more in a **single** application. Polyesters are applied at 50 to 100 microns. The thicker PPA571ES coating ensures that the edges are well covered and that the interstices of any wire sections are pinhole free.
4. Polyesters are by their chemical nature **water-permeable**. Water passing through the coating will bring with it acids or salts from the environment. These will attack the substrate beneath and cause blistering and cracking of the coating. PPA571ES is **hydrophobic** and so water will not be absorbed by the coating. Therefore salts cannot attack the substrate below unless the coating is damaged. Even if the coating is damaged the adhesive mechanism resists under-film creep and the coating is so flexible it cannot crack and fall off.
5. Polyesters have a similar chemistry to paints used by Graffiti "artists". Therefore solvents carry the colour into the polyester coating. The solvents used to dissolve the graffiti paint also remove layers of the polyester powder coating. PPA571ES, however, is **non-porous** to the graffiti paint solvents and so they do not penetrate into PPA571ES coatings. Therefore graffiti can be easily **wiped off** using a clean rag or cloth dipped in solvents (such as toluene or MEK) with little or no affect on the coating.
6. Plascoat PPA571ES is extremely **flexible** even down to -78°C. Polyesters even when fully cured do not have good flexibility.
7. From the coater's viewpoint, the thermoplastic nature of PPA571ES means that the shelf life of the product is many years but polyester powders will slowly **cross-link** and may become **unusable** after a few months, especially in hot climates.
8. Plascoat PPA571ES can be **over-spray d** with PPA571ES to give a thicker coating or alternatively with polyester if the thickness and corrosion properties or PPA571 are required but the hardness of polyester is also desired. In both cases inter-coat adhesion is assured.

9. Plascoat PPA571ES coatings can be easily **repaired** using the same polymer system. Plascoat can supply repair rods of PA571ES, which can be melted into the coating to produce an invisible repair. Polyesters can only be repaired with a solvent based paint which may not have the same physical or weathering properties as offered by the coating powder.

WGO.18/07/02

-- More information on PPA 571 --

-- PPA571 - case studies --

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